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GUIDE ON MAINTAINABILITY OF EQUIPMENT

PART I INTRODUCTION TO MAINTAINABILITY

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GUIDE ON MAINTAINABILITY OF EQUIPMENT

PART I INTRODUCTION TO MAINTAINABILITY

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GUIDE ON MAINTAINABILITY OF EQUIPMENT

PART I INTRODUCTION TO MAINTAINABILITY

0. FOREWORD

0.1 This Indian Standard (Part I) was adopted by the Indian Standards Institution on 29 December 1980, after the draft finalized by the Reliability of Electronic and Electrical Components and Equipment Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

0.2 This guide is intended to make recommendations for the standardization of maintainability practices, and to stimulate ideas in the maintainability field. Organizations acquiring items will find the guide useful in assisting them in defining maintainability requirements and associated programmes. Item suppliers will benefit from the use of this guide by gaining an understanding of the requirements for achieving and verifying maintainability objectives.

0.3 The other parts of this standard will be as follows:

Part II	Maintainability requirements in specifications and contracts
Part III	Maintainability programme
Part IV	Test and diagnostic procedures
Part V	Maintainability design studies
Part VI	Maintainability verification
Part VII	Collection, analysis and presentation of data related to maintainability

0.4 In the preparation of this standard, assistance has been derived from the IEC Document 56 (Central Office) 68 Draft — ' Guide on maintainability of equipment, Part I : Introduction to maintainability ' issued by the International Electrotechnical Commission.

1. SCOPE

1.1 This standard (Part I) describes maintainability and related design and use parameters, and discusses some of the activities necessary to achieve the required maintainability characteristics and their relationship to the planning of maintenance.

2. TERMINOLOGY

2.1 For the purpose of this standard, the terms and definitions specified IS : 1885 (Part XXXIX)-1979* shall apply.

3. CONCEPT OF MAINTAINABILITY

3.1 The maintainability concept is concerned with characteristics of design, manufacture and installation which affect an item's ability to conform to some specified requirements of use and of maintenance. This ability is usually measured in terms of duration of maintenance actions, preventive maintenance requirements, etc.

3.2 The maintenance times depend on:

a) the ability of the item to be retained in or restored to service (facility for diagnosis, accessibility of parts, etc), all conditions of use being taken into account. The maintainability of an item is concerned with these matters but subject to the restraints of **3.2** (b); and

b) maintenance support which is actually applied (personnel, training, stocks of spares, facilities, annuals, etc). The discipline of maintainability engineering consists in not only meeting a given requirement but also ensuring that the characteristic is met with maintenance support as planned by the maintenance organization.

4. GENERAL

4.1 An important portion of the cost of using an item (*see* Note) is the total resources spent in those tasks necessary to retain an item in or restore it to a satisfactory condition. This total effort is related to the number of these tasks, their complexity and duration.

NOTE — The term 'item' is used to denote any system, sub-system, equipment or part, that may be individually considered and separately tested. To avoid repetition, 'item' includes items, population of items, samples, etc, where the context justifies it.

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*Electrotechnical vocabulary: Part XXXIX Reliability of electronic and elelctrical items (*first revision*).

4.2 Actions performed during the design of an item and intended to affect the failure rate and the severity of the failures call mainly for reliability techniques.

4.3 Actions performed during the design of an item and intended to affect the preventive maintenance and the duration, cost and support requirements of all maintenance tasks call mainly for maintainability techniques.

5. MAINTAINABILITY ACTIVITIES

5.1 There are several objectives in connection with maintainability and maintenance whose definition and achievement during the system life would provide a cost-effective system. The objectives are described in **5.2** to **5.4**.

5.2 Planning Phase (Conceptual and Definition Phases)

5.2.1 *Determining and Defining the Environment* — The conditions of use and of maintenance of the item shall place restraints upon the maintenance concept and shall be considered during the feasibility study and the prediction of life cycle costs.

5.2.1.1 *Operational conditions*

a) Operating environmental conditions affecting the item.
b) Environmental conditions affecting maintenance.
c) Means of identifying maintenance needs, particularly failure detection and localization of cause.
d) Restrictions on access for maintenance purposes.
e) Equipment partitioning for maintenance purposes dictated by location, level of repair and skill classification of the maintainer.

5.2.1.2 *Resource conditions*

a) Existing or required organization, locality, personnel and training.

b) Resources already committed.

c) Flexibility in acquiring new resources.

5.2.2 *Defining Maintainability Requirements* — Maintainability requirements should take into account operational and reliability requirements and cost constraints. This should result in a quantitative maintainability specification statement considering the maintenance policy and other requirements for the item, although this will not always be possible. Guides on the maintainability clauses in specifications and contracts are given in IS : 9692 (Part II)-1980*. Consideration should also be given during this phase to the verification of the requirements [*see* IS : 9692 (Part VI)†].

5.3 Acquisition Phase (Design and Production Phases)

5.3.1 *Satisfying Maintainability Requirements* — An effective means of satisfying the maintainability requirement is to carry out a maintainability programme, designed as a logical part of the whole engineering programme. A guide to a comprehensive maintainability programme is given in IS : 9692 (Part III)-1981‡.

5.3.2 *Furnishing Maintenance Support Planning Data* — Maintenance support planning shall be carried out in step with the development of an item to ensure that the maintenance support is available when the item is put into use. The main elements to be included in the maintenance support plan are as follows:

a) Procedures for maintaining the item (including major overhaul)
b) Requirements for the initial provisioning of spares, facilities test equipment and tools.
c) Requirements for training the personnel.
d) Requirements for technical manuals, etc.

The plan will be consistent with the maintenance policy and will be continuously updated.

A system for the recording analysis and feedback of data should also be instituted. Recommended procedures for collection, analysis and presentation of data related to maintainability are given in IS : 9692 (Part VII)§.

5.4 Use Phase (Operational and Maintenance Phases)

5.4.1 *Performing Maintenance* (*Corrective and Preventive*) — The important maintainability activities are the collection, analysis, and feedback of maintenance data and thc improvement of the design which may lead to the modification of the item.

Guide on maintainability of equipment:

*Part II Maintainability requirements in specifications and contracts (*under preparation*).

†Part VI Maintainability verification (*under preparation*).

‡Part III Maintainability programme (*under print*).

§Part VII Collection, analysis and presentation of data related to maintainability (*under preparation*).